

Name (printed) _____

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Lab Section _____

Exam III Chaps. 9–11 in Young& Geller

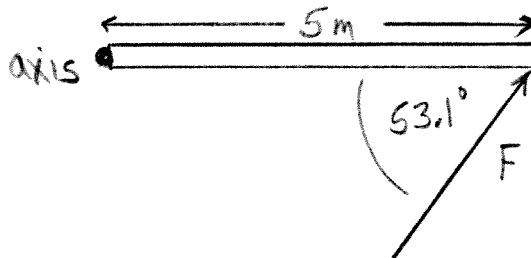
Circle the correct answer. No partial credit will be given.

(5 pts) 1. A block of mass m moves in simple harmonic motion on the end of a horizontal spring that has force constant k . When the amplitude of the motion is $A = 0.20$ m, the frequency of the oscillations is 8 Hz. If the amplitude of the motion is doubled, to 0.40 m, while the mass and the spring remain the same, the frequency becomes

- (a) 2 Hz
- (b) 4 Hz
- (c) 6 Hz
- (d) 8 Hz
- (e) 12 Hz
- (f) 24 Hz
- (g) none of the above

(6 pts) 2. A force $F = 20$ N is exerted at one end of a 5.0 m long bar as shown in the sketch. The force makes an angle of 53.1° with the bar. For an axis at the other end of the bar, the magnitude of the torque due to the force F is

- (a) zero
- (b) 60 N·m
- (c) 80 N·m
- (d) 100 N·m
- (e) none of the above



(5 pts) 3. A block moves on the end of a horizontal spring. It takes the block 0.10 s to travel from $x = A$ to $x = 0$. The frequency f of the motion is

- (a) 0.10 Hz
- (b) 0.25 Hz
- (c) 1.0 Hz
- (d) 2.0 Hz
- (e) 2.5 Hz
- (f) 4.0 Hz
- (g) 5.0 Hz
- (h) 10.0 Hz
- (i) none of the above

(6 pts) 4. A woman stands on a platform that is free to rotate and she holds a can of beans in each hand. With her arms outstretched, the moment of inertia of the system (woman plus platform plus cans) is $16 \text{ kg}\cdot\text{m}^2$ and she is rotating with an angular velocity of 9.0 rad/s . She then pulls the cans in to her side and the moment of inertia of the system becomes $12 \text{ kg}\cdot\text{m}^2$. What is her angular velocity after she pulls the cans in to her side?

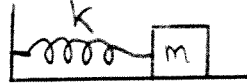
- (a) 10.4 rad/s
- (b) 12.0 rad/s
- (c) 16.0 rad/s
- (d) 27.7 rad/s
- (e) 32.0 rad/s
- (f) 42.7 rad/s
- (g) none of the above

(6 pts) 5. Starting from rest a disk rotates through 20 radians in 4.0 s. The angular acceleration is constant. If the disk has radius 0.30 m, what is the tangential acceleration of a point on its rim at the instant when the disk has turned through 20 radians?

- (a) 2.50 m/s^2
- (b) 1.25 m/s^2
- (c) 1.00 m/s^2
- (d) 0.75 m/s^2
- (e) zero
- (f) none of the above

On the following problems show all your work. Partial credit will be given if earned. Write your answers in the blanks provided.

(18 pts) 6. A block with mass 0.50 kg moves on a horizontal frictionless surface. The block is attached to one end of a horizontal spring that has force constant $k = 120 \text{ N/m}$ and the other end of the spring is attached to a wall. When the block is at $x = -0.40 \text{ m}$ its speed is 4.0 m/s.



(a) What is the maximum speed of the block during its motion?

Ans. _____

(b) What is the maximum magnitude of the force that the spring exerts on the block during its motion?

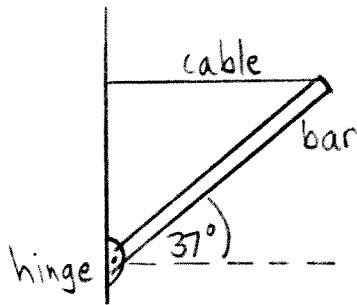
Ans. _____

(18 pts) 7. A thin-walled hollow sphere with mass 5.0 kg and radius 0.20 m is rolling without slipping at the base of an incline that slopes upward at 37° above the horizontal. At the base of the incline the translational speed of the center of mass of the sphere is $v = 12.0$ m/s. If the sphere rolls without slipping as it travels up the incline, what is the maximum vertical height that it reaches before it starts to roll back down?



Ans. _____

(18 pts) 8. A uniform bar has mass 30 kg and length 6.0 m. One end of the bar is attached to a vertical wall by a frictionless hinge. A light horizontal cable connects the other end of the bar to the wall and holds the cable at an angle of 37° above the horizontal.



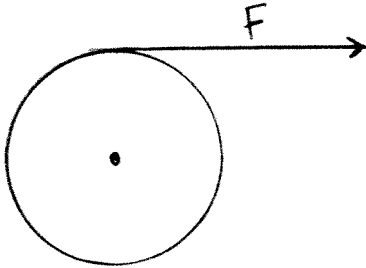
(a) What is the tension in the cable?

Ans. _____

(b) If the cable is cut, what is the magnitude of the angular acceleration of the bar just after the cable is cut?

Ans. _____

(18 pts) 9. A uniform disk with mass 40 kg and radius 0.20 m is pivoted at its center about a horizontal frictionless axle. The disk is initially at rest and then a constant force of $F = 30$ N is applied tangent to the rim of the disk.



(a) What is the magnitude v of the tangential velocity of a point on the rim of the disk after the disk has turned through 0.20 revolutions?

Ans. _____

(b) What is the magnitude a of the resultant linear acceleration of a point on the rim of the disk after the disk has turned through 0.20 revolutions?

Ans. _____